DOCUMENT RESUME

ED 027 382 VT 006 655

Anecdotal Abstracts From an Environment for Learning, Written at the 1966 and 1967 Summer Institutes of Technology for Children (Marlton, New Jersey).

Spons Agency-Ford Foundation, New York, N.Y.; New Jersey State Dept. of Education, Trenton. Div. of Vocational Education.

Pub Date 67

Note-72p.

EDRS Price MF-$0.50 HC-$3.70

Descriptors-Abstracts, *Case Studies (Education), *Elementary Education, *Industrial Arts, *Inservice Teacher Education, *Interdisciplinary Approach, Student Evaluation

Identifiers-New Jersey, Summer Institute Of Technology For Children, *Technology For Children Project

Abstracts which reflect a cross section of the anecdotal records made during two-6-week inservice teacher education institutes are presented. The institutes were designed to help elementary teachers combine technological activities with regular academic lessons for children in kindergarten through grade 6. Each of 38 teachers observed one child, who was in a group situation, one and one-half hours each day for 4 weeks and made the original anecdotal records. At the conclusions of each institute the teachers selected an area of interest and prepared an abstract from their records. The abstracts which report on pupils at the primary and intermediate grade level are: (1) "Reading and Language Arts" by Judith Motley, (2) "Mathematics" by Alma Merritt, (3) "Science" by Jean Stover, (4) "Language Arts" by Ellen Shinn, (5) "Vocabulary Building" by Mary Holzschuher, (6) "Industrial Arts and Science" by Barbara Pawlowski, (7) "Listening Skills and Mathematics" by Mary O'Malley, (8) "Science" by Carl Roache, and (9) "Mathematics" by Joan Errickson. Each abstract focuses on one pupil and their activities, problems and progress in one learning or subject area. (EM)

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from an "Environment For Learning"

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ENVIRONMENT FOR LEARNING.

Written at the

1966 and 1967 SUMMER
INSTITUTES OF TECHNOLOGY FOR CHILDREN

HELEN L. BEELER SCHOOL
MARLTON, NEW JERSEY

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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Special Thanks Go To:

All of the teachers from the Institutes who did such a fine job of evaluating their anecdotal records and writing their abstracts. Since time and space prevent us from publishing all of them, a group representing different age and grade levels, both city and suburban school children, 1966 and 1967 Institutes, boys and girls, plus various subject areas and approaches, was chosen. For allowing us to publish their abstracts we especially thank Joan C. Errickson, Mary Holzschuher, Almena Merritt, Judith Ann Motley, Mary O'Malley, Barbara Pawlowski, Carl Roache, Ellen Shinn and Jean Stover.

PREFACE

This document represents a cross-section of anecdotal abstracts taken from a group of teachers who attended either the 1966 or 1967 Summer Institute of Technology for Children.

During a six week institute each participating teacher had the opportunity to observe one child operating in a group situation 1½ hours a day for four weeks. It must be understood that, for most of the teachers, this was an initial record keeping experience and though the abstracts may prove extremely helpful in identifying valuable learning, they should not be considered polished clinical studies.

Each teacher devoted considerable time and energy to taking accurate anecdotal records and although at times finding the actual process of recording entries a trying and difficult task, each individual was gratified to discover how much factual information he had accumulated, and how much he could learn about the child and the institute.

At the conclusion of the summer institute, each observing teacher chose an area of interest and wrote an abstract using his record as primary source material. These abstracts reflect many different approaches to analyzing the record of a child in action and identifying many facets of the broad school picture.

It is hoped this cross-section of abstracts will help support the value of tool/material activity in terms of the whole elementary school curriculum, as related by the classroom teacher.

E.A.S.

The Summer Institutes of Technology for Children were conducted at the Helen L. Beeler Elementary School in Marlton, New Jersey as part of the Technology for Children Project sponsored by the Division of Vocational Education, State of New Jersey Department of Education, and The Ford Foundation.

The Institutes have helped thirty-eight teachers from some twenty-one elementary schools in the State of New Jersey implement this type of program in their classrooms, and has reached some 1,100 students to date.

The Institutes were designed to help teachers combine technological activities with regular academic lessons for children in grades K-6. The children are encouraged to work with a wide variety of tools and materials and are constantly confronted with problem solving situations.

Following the Institute, each elementary teacher provides for exploratory experiences in technology to help children discover their own interests and abilities (basic to intelligent vocational choice) so that they are in a better position to handle information about, and identify with, what people do in the world of work. In addition to classroom experiences, information about the world of work is presented through field trips, films, and discussion. The Project staff provides, during the following school year, Research Associates in Technology (I.A. Consultant) who work with approximately 12 elementary classroom teachers each, to provide them with the technical assistance they need to effectively implement this program in their classrooms.

Future institutes are being planned to further implement and test the basic theory of the Technology for Children Project.

READING AND OTHER LANGUAGE AREAS
Primary - Girl
Summer 1966

by

Judith Ann Motley

Background Information

Noreen was born in the North-East on April 25, 1960. She has one year of kindergarten experience in the township. She has dark brown hair, which she wears short with bangs, dark brown eyes, and dark complexion.

Noreen has one sister. Her father had eleven years of educational training and her mother had ten years of educational training. Her father now works as a mail carrier in the township and her mother is a housewife.

Comments from School Records:

Kindergarten

Health:	Normal
Days Absent:	15
Days Present:	165
Personality Record:	"Satisfactory"
Classwork Progress:	"Outstanding grades as far as class is concerned. Good student."
Work Habits:	"Always participates in class work (oral and written). Has leadership potential."
Social Adjustment: (Relationship with others)	"Well liked by everyone."
Parent Interest:	"Parents seem interested in her education. Encourage her to participate in all activities."

Evidence of Noreen's encounter with Language Arts with special emphasis in the areas of Reading and Spelling is supported by the observations in her anecdotal record.

Noreen's contact with Reading Experiences develop as her record progresses. An early example of Noreen recognizing her name occurred the first day of the Institute. Noreen had been playing in the home corner with some of the other children. Still wearing a stole around her shoulders, she walked to the back of the room. A helpers chart had been placed on the bulletin board giving the names of the children and the jobs they were responsible for. Noreen walked over to the bulletin board and looked at the helpers chart. Her name was beside the place for sweepers. She looked up at the chart and said,

"Funny, funny for putting my name up."

Noreen then walked back to the home corner.

A few days later, Noreen was in the back of the room working with paper and crayons. She showed her picture to Miss S.

She said, "Look what I did."

Miss S suggested that she make a folder out of her picture and write a story to put inside. Miss S got paper and wrote as Noreen stood beside her, and told Miss S the story. Noreen spoke so quickly that Miss S had to ask her to slow down so she could get it all copied down. Here is the story that Noreen gave Miss S.:

> "I have fun in summer school. I color pictures. We make jump ropes. We make lots of friends, we like to play with. I play with my dolly. I like to play with boats. We go out to play. We sit and eat cracker and cool pops. We cut wood with a jig saw. The boys are making a guinea pig cage for Noel. The teachers are writing. The boys learn to hammer and so do the girls. The girls and the boys cut pictures. We play with blocks."

After Noreen had finished her story, she read it with Miss S's help.

At the end of the first week, the children gathered in a circle to discuss the jobs they would be doing for the next week.

Mr. J said, "Now we need sweepers."

Noreen raised her hand and bit her lip.

Mr. J said, "We need someone to take care of -----"

Noreen raised her hand before Mr. J could finish. Mr. J looked at Noreen and said, "Benches."

Noreen said, "0000h."

Mr. J looked at Noreen again, and said, "Noreen."

Noreen grinned and walked over to the board and put her name in the slot beside the word benches.

On another occasion, the children were in the circle discussing what needed to be finished and the specific jobs each one had to do before juice time. Miss S was talking with the children about what they would like to do.

Noreen said, "I'm working on the house."

Miss S wrote the word house on the board.

Noreen sat talking to herself (it seemed): "Noreen work on the house. Chris work on the house. Noreen work on the house."

Miss S wrote the word stools on the board. She suggested that the children switch around on their jobs and get a chance to work on more than one thing. She said those who had worked on the stools could now work on the house.

Noreen called out, "And I worked on the stool, so I get to work on the house."

Miss S wrote Noreen under Wally's name which she had put under the word house.

Noreen watched as Miss S wrote her name on the board, and said, "Yippee! I get to work on the house."

Later on, the children were working with plastic. After the initial work period, they were deciding what they were going to do in their free time.

Noreen said, "Miss S, I want to work in plastics."

Miss S began to write names under the word plastic. Noreen waved her hand, frowned, waved her hand and said, "OOOOh."

Miss S wrote three names under plastic. Noreen called out, "I want to work on plastic."

Miss S wrote Noreen under the word plastic. Noreen said, "OOOOh, I get to work in plastics," and clapped her hands.

The children went on a field trip to see a building being demolished. After they returned from the trip, they sat in a circle and discussed various things that they had experienced. As they mentioned various things, Miss S wrote them down on the board.

Noreen broke into the conversation, "That thing pushing dirt."

Miss S said, "Bulldozer?"

Noreen shook her head yes. The other children began to talk about noises on the bus. One child said, "Bumping."

Noreen joined the conversation again, "The bus motor starting."

The discussion turned to things they had seen and heard at the building. Miss S asked, "What were the walls made out of?"

Noreen said, "Rock."

Wally said, "Concrete."

Noreen said, "Rock."

She paused a moment, and said, "It made a noise when the house fell down. I saw a lock falling down."

Miss S asked, "A rock?"

Noreen shook her head no and said, "No, a lock."

Miss S asked, "How big was it?"

Noreen showed about five inches with her hands.

Miss S said, "Are you sure you saw that, Noreen?"

Noreen said, "Yea."

Miss S asked, "Anything else?"

Noreen said, "We saw smoke (paused) the smell like the ocean."

(The building was by the river front.)

Another child made a comment, and Noreen replied, "The smell of the river."

Miss S and the children read what was on the board together. Noreen looked as Miss S pointed to the words. As older children in the group read the story, Noreen repeated the words softly.

There are at least thirty other places in Noreen's record that specifically substantiate her direct encounter with reading and other phonetic skills.

In addition to reading, there is evidence of Noreen's encounter with language expression and vocabulary building as supported by the following observations pulled from her anecdotal record.

The children were learning about electricity and conducting various experiments. On one particular day, the children had gone outside the school and were discussing how electricity got into the school. Noreen looked up at the poles outside the school, and said, "By those wires."

Mr. J said, "Why do you suppose it is in wire?"

Noreen answered, "Electricity is too strong."

Various children responded. The discussion then turned to the transformer. They discussed what a transformer was, its function. The children then returned to go back to the building. As they were walking back to the school, Noreen looked at Mr. J and said, "Mr. J, I could have told you that was a transformer."

After entering the school, the children went to the boiler room. They wanted to know where the utility box was stored. They discussed how electricity got back into the building.

Noreen said, "By those pipes."

Mr. J asked, "Where does it go from here?"

Noreen said, "To the rooms."

Mr. J said, "Right."

There was more discussion from the other children and then they all returned to the classroom.

On a later occasion in the room, the children were doing experiments with electricity to determine what objects were conductors and what objects were non-conductors. Noreen went to the front work space and asked to work.

Miss S said, "Noreen, I will help you strip that wire. Why do you suppose I have to strip it?"

Noreen answered, "I don't know."

Miss S said, "This covering is a non-conductor."

Noreen said, "Oh, electricity doesn't travel through plastic."

Miss S said, "Right."

Noreen continued to work on connecting the wires to the batteries. Noreen turned to Lisa and said, "I need the screwdriver."

Noreen stamped her foot and said, "How come this thing isn't going around?" (She was trying to wrap the wire around the top of the battery.)

Miss S said, "You can ask for help when you get into trouble."

Noreen answered (in what seemed a disgusted tone), "Oh, boy!"

Miss S asked Noreen, "What do you mean, oh boy?"

There was no explanation from Noreen. Instead, Noreen walked over to the tool cart and got a nail set, came back to the table and put it on the screws, touched the wire to it and the small bulb lit up.

Noreen said, "Miss S, it's a conductor!"

There were numerous experiences provided for the children in the Institute which broadened each child's language expression and vocabulary building. Such an experience was a demonstration given by a telephone man. man. He brought his truck and explained about safety, his equipment, how the telephone worked, what he did on telephone poles, and the different wires that were on the poles. The telephone man was explaining the parts of the telephone and had just demonstrated the ringer when Noreen spoke out and said, "Sounds more like a bell."

The telephone man said, "That's what it is, a bell. We call it a ringer."

He then explained how you turned your phone off by the switch on the inside.

Noreen asked, "Does it disconnect you?"

The telephone man said, "Right."

There was more discussion and questions from the children. Then Mr. J asked, "Why do we need poles?"

Noreen answered, "I don't know."

The telephone man started putting on his equipment to climb the pole for the children and explained how careful he must be not to touch certain wires. Noreen listened and then said, "I put one battery with another battery and it blew the light out."

After her comment, there was a discussion on electricity and how strong it is.

The telephone man said his belt held his equipment and he put it on like a gun belt. Noreen said, "Only it holds equipment."

The telephone man showed the children his stirrups and how he put them on and how they helped him to climb the pole. Noreen watched as he put the stirrups on and then said, "They look like the stilts the man had we saw."

Miss S answered, "Right, at the houses we saw him."

(The children had gone on a field trip to see various stages of building construction of houses in progress. In one of the houses the plasterer had small stilts strapped to his shoes, enabling him to move about freely as he plastered the ceiling. The children were quite enthralled by this.)

The discussion continued about the poles, wires and electricity. Mr. J said, "Why does the tube have two wires in it?"

Noreen answered quickly, "Electricity path. You can tell you have to be careful with some of that stuff."

Spelling was integrated frequently in the program as is evidenced from Noreen's record. The children were preparing to start a project and were discussing the tools they would be using and their names.

Mr. J asked the children, "Why do you call it a hand saw?" He was holding a hand saw before the children.

Noreen answered, "Because you use it with your hand."

Mr. J wrote on the board the words hand saw. Noreen watched as he wrote the words on the board and began to spell out the letters. Noreen spelled out loud, "H-a-n-d s-a-w."

Mr. J turned back to the children and asked, "Used for cutting what?"

Noreen said, "Wood."

Mr. J held up a hack saw and said, "Ever see one of these before?"

Noreen looked and then said, "No."

Mr. J wrote on the board the words hack saw.

Again Noreen watched and began to spell, "H-a-c-k s-a-w."

The children then began to discuss the jig saw. Mr. J asked, "It runs by----?"

Noreen answered, "Electric."

Mr. J wrote the words jig saw on the board.

Noreen spelled out the letters, "J-i-g s-a-w."

On another occasion, the children had been to see various stages of construction and after they returned from the trip, engaged in a discussion. As a result, the children decided to write a thank-you note to Mr. Hovnanian, the owner of the development.

The children went to the back of the room to write a thank-you letter. Miss S asked who they were going to thank. Noreen looked up at the board where the name of Mr. Hovnanian had been written.

Noreen spelled out the letters, "H-o-v-n-a-n-i-a-n"

Miss S had paper to write the story down as the children gave her the story. Miss S said, "What do we want to say to Mr. Hovnanian?"

Noreen said, "We thank you."

Miss S repeated, "We thank you."

Noreen said, "We thank you for-"

Another child spoke up and said, "Soda."

Noreen watched Miss S as she wrote the words on the chart and spelled out the letters, "S-o-d-a."

Miss S asked, "What else can we say, Linda?"

Noreen interrupted, "Oh, I know."

There were other comments from the other children. Noreen sat quietly for a while and then said, "Don't forget to write thank you for showing us inside of the house."

Noreen spelled out the letters, "I-n-s-i-d-e."

Noreen said, "Miss S, can I tell you something that is real nice to say?"

Miss S answered, "What were you going to say that was real nice, Noreen? Do you remember?"

Noreen said, "The houses turned out nicely."

Miss S repeated, "The houses turned out nicely."

Miss S wrote the words down and then asked, "How do you end a letter?"

Noreen said, "Thank you."

Miss S wrote thank you and additional comments from the other children. As she finished the letter, Noreen said, "Put a stamp on it. Can I put a stamp on it?"

There was no immediate response from Miss S and Noreen got up and walked over to where Mr. J was working. She said something to Mr. J, turned and walked back to where Miss S and the rest of the children were finishing the letter.

On still another occasion, the children were working with plastic. The children had been trying many different experiments. They had

gathered in a circle to discuss what they had learned and what they had been trying.

Mr. J wrote the word plastic on the board. Noreen said, "You made an i."

Mr. J said, "No, plastic."

Noreen got up and looked closely at the word on the board and said, "You didn't put your line under the l."

Mr. J said, "This is a small l."

Noreen said, "Oh."

Noreen's encounter with penmanship is substantiated throughout her record. On many occasions, she expressed the desire to write her own name and finally to write her own stories. She often wrote her name on the board to have a turn on various projects.

One such encounter was when the children were publishing a book of their own stories and illustrations. They were working with printing with the use of type and blocks.

Miss S had helped Noreen set up her type for printing. Noreen looked at Miss S and said, "Can I do it myself?"

Linda inked the type for Noreen and Noreen rolled the roller over the type and printed her name. Linda began to ink the type again. Noreen said, "I want to ink it myself."

Miss S said, "You'll get four times to ink the type again. But Linda inks while you print."

Another example of Noreen's encounter with penmanship incorporated with industrial arts and technology occurred toward the last of the Institute.

Miss S was in the back of the room busy helping another child to record her story in the book. Noreen walked over the Miss S and said, "Oh, can I write a story?"

Miss S looked at the blackboard and said, "Is your name up there?"

Noreen looked at the board and said, "No."

Noreen went to the board and printed her name. She came back to Miss S and said, "I put it up."

Noreen watched as Miss S checked to see if her name was on the board and then began to get paper ready for Noreen. Noreen said,

"I can write my own story."

Miss S said, "Can you spell the words?"

Noreen shook her head from side to side.

This is the story that Noreen wrote:

SUMMER SCHOOL by Noreen

> "We jump rope. We make lots of friends. The boys and girls are nice. I like Lisa. We learn how to read. We are making book covers. We printed it then we took a saw and put it under the paper and color on top."

The more I studied Noreen's record, the more I discovered how many areas of the curriculum had been completely interwoven into her experiences. I came to the conclusion that all areas of the curriculum as we normally set up to be vital areas of learning are so interwoven that it is impossible to isolate any area and say this is purely reading, or spelling, or mathematics, or any other area.

As you can observe from the examples already given, which support encounter of various areas in Noreen's experience, none of these are isolated blocks of learning but rather have overlapping concepts and skills which apply to several areas or concepts of learning.

Noreen's record is a very lengthy one and there are many examples which could be cited to support her encounter with numerous areas of learning, especially in the area of Language Arts. The following examples are but a few to show how well these areas are interrelated.

The children were having a discussion about the experiments they had been making with electricity. Wally and Ed showed that they had made a magnet. Mr. J. asked, "What is this?"

Noreen answered, "Magnet."

Mr. J asked, "What does a magnet do?"

Noreen said, "It sticks to things."

Mr. J did something on the magnet. Mr. J went on with some experiments with the magnet that Wally and Ed had made. He turned to the children and said, "I know Noreen found out something special."

Noreen responded, "My bulb burned out."

Mr. J asked, "How?"

Noreen said, "I put too much electricity in it."

She stopped a moment and then said, "I put a screw in and the wire went kaput."

Mr. J said, "Noreen put two batteries together and it burned it out."

The children began to name conductors.

Mr. J asked, "What is alike about all of these things?"

Noreen said, "Electricity."

Mr. J asked, "Most conductors are made out of what?"

Noreen said, "Glass."

Mr. J asked, "Are they?"

There was more discussion from the children as to what conductors were made out of.

Noreen said, " I meant that light bulb there."

Mr. J asked, "Anyone else find out anything?"

Noreen said, "I did."

Mr. J asked, "What?"

Noreen answered, "I put an egg beater in and it worked."

Mr. J got some other objects from the back of the room. Noreen asked, "Mr. J, why don't you try your ring?"

The ring was tried and proved to be a conductor. Noreen said, "I still have that band-aid from yesterday."

The experiments went on and after a brief time, Noreen interrupted and said, "Mr. J, I got to tell you something that happened last night."

Mr. J: "We have plenty of time for you to tell me."

There was more discussion from the others. Noreen raised her hand and said, "Mr. J, I got something funny to tell you."

Mr. J asked, "Is it about electricity?"

Noreen said, "Yea. Last night I went to bed and the electricity went off for two hours."

Mr. J asked, "What made it go off?"

Noreen said, "The lightning was too strong."

As Noreen's experiences deepened, it became more and more difficult to see separate areas of learning. As you can see from the following examples, science, reading, spelling, and many other areas are beautifully and naturally interwoven into a much more valid learning experience.

Miss S went to the board. The children were dividing into groups and working on various experiments and then sharing their learnings with the other children.

Miss S wrote on the board the words conductors and non-conductors.

Noreen read, "Non-conductors and conductors."

Miss S said, "Yes, we will find out what are non-conductors and what are conductors."

Mr. J asked Noreen who she would like to work with and Noreen chose Lisa. Mr. J said, "Is that all right with you, Lisa?"

Lisa shook her head up and down indicating yes.

Noreen went to the middle work space. She picked up some wire and said, "Miss S, can I start this?"

Noreen turned to Terry after getting a positive response from Miss S and said, "You work on this battery."

Noreen pointed her finger at one of the batteries and said, "I'm putting the switch on mine." The light came on and Noreen ran to the front of the room and asked Miss S, "Miss S, do you have a light I can borrow?"

Noreen received another light bulb and worked for a long time. Noreen said, "How do you get this thing to work?" She went to the tool cart and said, "I found a wrench."

Mr. J asked, "What have you found so far?"

Noreen pointed to the screws and another object I couldn't make out, and said, "This and this."

Mr. J said, "Hold metal with pliers."

Noreen took a screwdriver and put it to the battery. The light lit up. Noreen said, "Yea. Conductors!" She then tried the center punch and the light barely lit up. Noreen said, "I'm waiting for this darn thing to work. Here it goes, Lisa. Put it down as a conductor. It works. Put nail down as conductor, it works."

Lisa said, "This one she tried."

Noreen said, "And it works." Noreen walked to the tool cart, humming to herself. She looked through a box and picked up some drills.

Noreen called to Mr. J, "Mr. J, can we try one of these?"

Mr. J said, "Yes, those are drills."

Noreen said, "Oh yea, I'm gonna try everything." She worked with the drills and then returned.

Noreen said, "Miss S, you want to see how much I did?"

Miss S said, "Did you write them down?"

Noreen said, "Lisa did."

Noreen went on with her experimenting and said to Lisa, "Put light by itself works. Mr J, paint brushes work. Mr. J, paint brushes work."

Mr. J asked, "Paint brushes work?"

Mr. J said, "You tried everything? You have things that work, but none that don't work."

Noreen tried a piece of wood. She said, "OOOOh, put wood down. Wood as a non-conductor."

Noreen picked up an egg beater and put it to the battery. She said, "I tried the beater. I'm gonna get more things." She picked up a piece of flour dough the children had been playing with in the home corner. She called out, "Mr. J tricked me. I'll give you a pie in the face."

Noreen tried a switch and said, "OOOOh, Mr. J, this switch works."

Noreen tried plastic, rubbed wire under the plate, and said, "Doesn't work."

Mr. J said, "What is that called, Noreen?"

Noreen answered, "Non-conductor."

Noreen walked over to the board and wrote plas, stopped and asked, "How do you make a t?"

Lisa said, "How do you make a t?"

Noreen wrote t on the board and Lisa told her how to spell the rest of the word.

Noreen went back to the work space and tried a tack. She called out to Mr. J, "Mr. J, tack works."

Mr. J said, "Write it down."

Noreen picked up some wire and said, "This works, this works."

Mr. J said, "Wire."

Noreen tried a coat hanger and shouted, "Yea!" She turned to Lisa and said, "You write up everything, Lisa."

Noreen went to the home corner and played with some dough. After a few minutes, she returned to the work space and tried a screw-driver. Noreen put all of the things in the bowl. Noreen said, "I'm all done, Mr. J."

Noreen saw some wire and picked it up. Miss S said, "Yea, try that."

Noreen said, "Miss S, Miss S, try your glasses."

Miss S said, "Want to try my shoes?"

Noreen laughed, "Try her shoe."

Noreen tried the shoe (it was a canvas shoe) and said, "Shoe, non-conductor."

Noreen tried a battery and said, "Battery, non-conductor."

Noreen's bulb burned out, and she said, "My bulb burned out."

Mr. J asked, "Why did it burn out?"

Noreen answered, "You put too much electricity in it."

They put a smaller battery to the other one and it gave a strong light, then the bulb burned out. Noreen picked up a popsicle stick.

Lisa said, "That won't work, it's wood."

Noreen said, "I don't care."

Noreen tried crayons and called to Lisa, "Non-conductor."

Next Noreen tried a sponge and said, "Non-conductor," and tossed the sponge in the skillet. Noreen and Lisa left the work space and went to the home corner and began to play house.

A final example of how industrial arts and technology, and all other areas of the curriculum can be interwoven naturally is brought out in the following example from Noreen's record.

The children were again working with electricity. Miss S was working with Noreen.

Miss S said, "Noreen, I will help you strip that wire. Why do you suppose we have to strip it?"

Noreen said, "I don't know."

Miss S said, "This covering is a non-conductor."

Noreen said, "Oh, electricity doesn't travel through plastic."

Miss S said, "Right."

The reaction to this study of Noreen's record is that industrial arts and technology do enhance the learning of a child. A child's concepts are widely broadened and their entire learning process becomes much more meaningful. It is believed the above examples from Noreen's record support the fact that industrial arts and technology can be successfully woven into the elementary curriculum.

Furthermore, with the proper planning, preparation and guidance, all phases of the curriculum will be so interrelated that there can be no isolated blocks of learning.

MATHEMATICS
Primary Level - Girl
Summer 1967

by

Almena Merritt

In analyzing the anecdotal record of Vicky, there is evidence of encounters with many facets of the elementary curriculum.

Mathematics has been chosen for this paper, and evidence of Vicky's encounters with mathematical concepts will be presented.

The anecdotal record does not involve, nor does it describe every action or experience of Vicky in this area. However, it includes much evidence of the mathematical concepts encountered throughout the period of observation.

This abstract is constructed from an outline of anecdotal records by subject area. Some examples are:

A. Number vocabulary
B. Temporal measurement
C. Mathematical skills
D. Linear measurement
E. Dry and liquid measurement
F. Geometric shapes
G. Structuring phrases and sentences that require solutions in mathematics
H. Number concepts
I. Computations
J. Conclusions and implications

Vicky's encounters covering vocabulary building of mathematical skills have been enlarged through concrete experiences with the use of measuring tools, namely, rigid steel tape, zig zag folding ruler, try square, bench rule, linear measurement of string and use of hands. Through readiness discussions of daily plans, counting of materials, and construction of many projects using dimensions in all of her work she has been exposed to many mathematical terms.

Vicky was able to see, listen, touch, construct, measure, and compare mathematical concepts in daily work. She seemed to understand meanings of number concepts through use in actual situations as they applied to her, or something with which she was familiar. More formal mathematics will later grow out of these experiences.

Temporal measurement was encountered through mass production projects, time allotment for completion of activities, and the temporary arrangement of work areas. Vicky expressed great interest in the cooking of popcorn and in getting the story book assembled.

Measuring tools were used at different times. Vicky encountered many experiences when given articles of different shapes and sizes to measure. An example of this would be the use of many measuring devices in the construction of the store. She experienced processes of mathematical skills in determining extent, dimensions, inches, yards, and feet.

Vicky encountered the making of comparisons through measurement of the store front and sides to see that materials were accurate in length and width.

Many mathematical concepts were experienced through field trips. Examples: The trip to the clay company presented many counting experiences. Vicky counted many bricks and compared the textures of the clay.

She made many comparisons of things in terms of sizes and structure on the trip to historical Batsto.

Comparisons of individual projects were expressed in terms of number, form, place, time, money, and speed. Examples:

Sizes:
big, little
Form:
curve, straight
Number:
first, second, third, etc.
Place:
above, below
Time:
minute, year
Money:
penny, dollar
Measure:
inch, yard
Speed:
fast, slow

Linear measurement was expressed as Vicky learned how to measure objects and materials with string and fingers. Example: She used her hand to measure distances between nails being inserted to join sides of the store.

Dry and liquid measurement were encountered as Vicky experienced measuring dry corn in a measuring cup before pouring it into the skillet. She measured three tablespoons of Wesson oil to each skillet of popcorn. She also experienced melting solid material into liquid form with caramel squares. The popcorn cooking lesson proved meaningful and creative.

Vicky has learned to differentiate between sizes, shapes, and structure. She made drawings of shapes on a piece of masonite, and cut them out on the jig saw. Finally, she arranged them on drawing paper to resemble a man, and pasted them in the same design. Some were oval, round, oblong, and triangular in structure.

Vicky recognizes numbers from one to twenty. She understands small amounts of things. She encountered number readiness in many areas mentioned previously. Children were observed on this primary level being made aware of the usefulness of all mathematical concepts in various subject areas.

Vicky understands time in terms of recess, snack, worktime, story time, clean-up, or evaluation of projects.

She also encountered mathematical skills as they apply to the following:

enough	as many
not enough	more than
too many	one for each
fewer	

Vicky gained a great deal of mathematical experience during the Institute. She explored in many new areas and experimented with measuring tools and devices.

This program provided a wide variety of experiences at every level to stimulate creativeness and motivate responses from children.

NUMBER CONCEPT VOCABULARY

#1 Size concepts

big - little
heavy - light
large - larger
small - smaller
long - short
wide - narrow
half - whole
thick - thin
tall - shortest
high - lowest
large - er - est
small - er - est

#2 Form concepts

curve - straight
square - round

#3 Number concept

first - second - third - etc.
all - none
more - less
most - least

#4 Place concept

above - below
over - under
top - bottom
first - last
far - near
middle
next

#5 Time concept

minute - year
morning - afternoon - evening
yesterday - today - tomorrow
early - late
day - night
long - soon
calendar - clock

#6 Money concept

penny - dollar
buy - sell
pay - paid
cost - price
spend - money

#7 Measure concept

inch - yard
½ pint - gallon
dozen
height - weight
fractions

#8 Speed concept

fast - slow - er - est
quick - swift

#9 Additional vocabulary

add - take away
all - none
before - after
beginning - end
day - night
early - late
slow - fast
square - round
thin - fat
few - many
full - empty
more - less
narrow - wide
near - far
over - under
short - tall
straight - crooked

MATH VOCABULARY

above
after
ahead
alike
as many as
back
before
begin
behind
below
beside
between
big-er-est
cent
center
circle
closed
corner
count
deep-er-est
difference
distance
down
each
early
edge
eight
eighth
empty
enough
far
fast-er-est
fifth
first
five
forward
greater than
half
halves
heavy
height
high
inch
join
large
last
length
less
light
little
long-er-est
low-er-est
many
much
measure
member
narrow
near
next
ninth
old-er-est
one half
order
pair
pattern
point
rectangle
round
ruler
second
seventh
several
shape
short
side
sixth
size
small
some
square
straight
tall
ten
time
triangle
under
uneven
unit
upper
unit
weight
whole
wide
width
yesterday
zero

SCIENCE
Primary - Boy
Summer 1966

by

Jean Stover

Juan R. is seven years old. In September he will enter the third grade in a large city school. His parents are from Puerto Rico and Juan himself was born there. He has been attending an English class for Spanish-speaking children. He has one brother, Pablo, who will be entering the fifth grade.

Juan worked with a primary group in the Summer Institute. His teachers were Mrs. L and Mr. J. There were eleven children in the group. Juan attended every day of the Institute.

Anecdotes on Juan were taken 1½ hours each day and from these anecdotes the area of science was chosen to write an abstract.

Science was presented to Juan in many ways, through experimenting, discovering, using scientific tools, sensory experiences, teacher instruction, and work projects.

This abstract report has been divided into the areas of science in which Juan participated.

Machines

Juan was exposed to machines through pictures that had been placed on the bulletin board. He had an opportunity to look through magazines and cut out pictures of machines. Pictures found by the children were mounted and placed on the bulletin board. Through pictures and discussion, Juan found that even tools were simple machines that helped us perform our jobs. During the time Juan was observed, he used many tools including the hammer, hand saw,

jig saw, electric drill, file, sandblock, level, hand drill, clamp, pliers, and screwdrivers.

By helping to raise the flag one morning Juan saw that a pulley was needed to get the flag to the top of the pole. This experience led to a teacher-directed discussion of pulleys. Mr. J showed the children pictures of pulleys. Juan saw that windows are raised by pulleys and many large and heavy objects are lifted with this machine. Juan experienced lifting a cinder block with the help of a pulley that had been installed in the classroom.

Juan saw machines at work on his trip to the brick factory. Machines were used to dig the clay, then refine it, and mix it with other materials. The bricks were moved and cut by machinery.

Magnets

A table displaying a variety of magnets was set up in a corner of the room for use during the summer school. Some days new things were added and others taken away. Any time a child was free and interested, he could go to this table and experiment. In the anecdotal record, Juan was observed going to this table and using the magnets nine times. These problems were put on a chart to encourage the children to experiment.

Do magnets attract cork?
Do magnets attract wood?
Do magnets attract iron filings?

Juan made an electro-magnet by coiling wire around a bolt and attaching the ends of the wires to a battery. This was mounted on a wooden crane that he had made. The finished product was called an Electro-Magnet Crane. Juan picked up nails and tacks with his electro-magnet. When he saw that his magnet really worked, he called very enthusiastically to his friend Jimmy, "Look, look, it works!"

Working independently, Juan magnetized a nail, using a dry cell. This time he shared his enthusiasm with Mr. J, "Look, Mr. J, I made this nail into a magnet."

Electricity

Juan used electricity when he worked with the jig saw and power drill. He had to "plug in" the strip heater and fry pan when he needed heat to soften plastic.

One day Juan had an opportunity to see, feel, and hear electricity. He felt it when he touched two wires connected to a battery. He saw it when the two wires were touched together and sparks resulted. He heard it when he listened through earphones that were connected to a transformer. His comment when feeling electricity was, "Ouch, it stung me!"

Mr. J gave this problem to the class: "How do we get power from this battery?"

Juan contributed, "By putting on wires."

A circuit with a buzzer attached was set up by Mr. J. The children were to experiment with different materials about the classroom and find which were conductors and non-conductors of electricity. These were to be written on the board under the correct heading.

Juan tested a kaleidoscope, a magnifying glass, pin, metal part of pencil, paper, and a steel protractor. When he tested a can, he discovered that the painted portion did not make the bell buzz, but the bottom of the can that was not painted, did.

Juan was called on at the end of the lesson to read from the board all the conductors that the children had written. There were fifteen conductors listed.

Soil

On the class trip to the brick company clay pits, Juan had an opportunity to see clay-bearing soil and to handle the soil looking for clay deposits. He found many clay samples. One sample that was moist and pliable he took with him. Occasionally, he took it from his pocket and molded a shape with it. He had an opportunity to compare this soil with soil containing bog iron on the class trip to Batsto.

In the classroom, Juan made a cup from clay. Clay slip was poured into a mold. Later it was baked in a kiln to harden, just as the clay bricks were baked at the brick company.

Juan also helped to mix concrete to hold the poles for the cable car project. This was done when the children discovered that the soil was too soft to hold the poles tightly.

Sight

Mrs. L and Mr. J presented the children with the problem of "How do we use our sight?" The children entered the room one morning to find many different types of optical instruments placed around the room. Juan quickly went to the microscope and looked through it. He also looked into the kaleidoscope, telescope, magnifying glass, and binoculars. He seemed to perceive the purpose of these instruments because later when he was asked, "Why do we have all these things to help us see?" his answer was, "So we can see things closer." To culminate the unit on Sight, Juan and the other children made a periscope. The instruments were left in the room for the remainder of the summer school and Juan experimented with them many times.

Science Demonstrations

Juan attended two science demonstrations. One demonstration was on Space given by Mr. Gibson from NASA. The other was the principles of flight given by Mr. Bueschel of Trenton State College.

On the last day of school, the children were asked what experience they liked best. Juan said he liked his electro-magnet best. When Mr. J asked him why, he said, "Because it has a battery and it works."

The children also compiled a book of their summer experiences. Juan wrote this story:

THE ELECTRO-MAGNET

" "I like the way I did it. It was easy to do. First, we started with the car. Then we put the block of wood on top of it. Then we took a long piece of stick and put it on the side of the block. This is called the boom. Then we rolled up the wire on a bolt. Then we put the wire on the boom and then nailed the copper pieces on the car to hold the battery and the switch. Last we put on the four wheels. And that is the end."

LANGUAGE ARTS
Primary - Girl
Summer 1967

by

Ellen Shinn

The data for this abstract was accumulated from July 3 to August 1, during the 1967 Summer Institute of Technology for Children. The observation sessions, from which this data was abstracted, were one and one-half hours a day. The abstracted anecdotes deal with the children's encounters with language arts.

In language arts, five areas were chosen: reading, spelling, grammar, written symbols, and creative writing. Reading was broken into two parts: phonetic analysis and vocabulary building. Spelling included the correct spelling of words written by the students or used by them. Grammar involved correction of written material, in the areas of capitalization and punctuation. Written symbols included identification and formation of letters. Creative writing was any writing children did on an individual or group basis, in which the ideas came entirely from the children.

The child observed is Peggy. She lives one block from the township school which she attends. Peggy is six years old and will be entering first grade in September, 1967. She is a thin child with light brown hair, which is often worn in a braided ponytail. There are three other children in the family, all of whom are boys. Peggy is the youngest child.

Peggy was a part of Team I, under the direction of Mrs. S. and Mr. R. Many of the language arts experiences Peggy encountered were presented by Mrs. S. through daily messages on the blackboard.

The children read these messages orally as a daily activity. The messages concerned activities in the classroom.

Phonetic analysis will be presented first. Peggy had eighteen encounters with this area. The following are several anecdotes chosen as examples in this area. These anecdotes are in sequential order, from the earliest to the most recent. All the anecdotes in this abstract will be presented in this manner.

> Mrs. S. asked Mr. R. to help Peggy with her steps. Peggy watched Mr. R. and then moved on to Jim, who was under the table. She sat down and watched Mrs. S. and Jim. Mrs. S. was using the typewriter and writing what Jim said. Peggy was watching. Mrs. S. said, "Peggy, I bet you could read it to him a little later." Peggy said "No" softly.
>
> Billy read the sentence story on the board. The children were asked to find 'boat'. Peggy didn't raise her hand. She did not raise her hand to find any words on the board.
>
> Mrs. S. said, while discussing the message for today, "Peg, can you find a place where it says 'louder'?" Peggy shook her head "No." Then the whole group read the story out loud until they came to another 'louder'. Peggy then went up and underlined the word 'louder'. Message - Peter found out that electricity can make wires very hot. We made the bell ring louder and louder and louder. We made the light brighter and brighter. Will we need electricity in our store?
>
> Mrs. S. chose a boy to read the message for the day. She asked if anyone saw the word 'rule'. George jumped up and pointed to will. Mrs. S. told him that wasn't rule. She then chose Peggy, who circled rule. Mrs. S. asked children for words that rhymed with make. Cake was named. Peggy raised her hand and said, 'Cake'.
>
> Mrs. S. told them rake rhymed with make. She asked what letter rake began with. Peggy said 'r'. Peggy was asked to spell rake. She did not. Mrs. S. spelled it.
>
> Mrs. S. asked Peggy, "Can you find a word that starts like soon?" Peggy raised her hand. She pointed to have. Mrs. S. said "No." Barbie said, "It has to start with s." Peggy then pointed to the word Suzanne. Mrs. S. said "Do you see another word that starts like Suzanne, store, soon?" Children called, "Me!" "Me!" Peggy was waving her hand and standing up.

The children were looking for words that start like 'pink'. Linda found plastic. Peggy came up. After looking several minutes, Peggy pointed to 'print'. She drew a pink circle around it. Peggy stood up for the last two minutes.

Mrs. S. said, "Peg, show me where it says 'popcorn'." Peggy pointed to tablespoon. Mrs. S. said, "No". Peggy then ' pointed to the title 'Popcorn'. Mrs. S. said, "Good. Where's another one?" Peggy pointed to another.

Continuing with reading, the area of vocabulary building will be presented. Peggy had a total of eleven encounters with this area. The following are some examples of this:

Peggy looked around the room. She looked from the job charts to Mr. R. He asked children names of tools drawn on the board. Peggy raised her hand and named a drill.

Mr. R. held up a square. He said the name of it. He asked, "Peggy, what is it called?" She replied, "A square".

Peggy pointed to a plastic triangle and said, "What's that?" Mr. R. said, "That's Barbie's measuring device."

Peggy went to Mr. R. and said, "I'm a sweeper. See?" She pointed to the work chart. A few minutes later, she said again, "Mr. R., I'm a sweeper. It says so on the board." She repeated the statement.

Peggy had eleven experiences with spelling. In some cases, the words were written by her, and in other cases they were written by other classmates or one of the instructors. The following are examples:

Mrs. S. said, "Hold it there." She took Peggy's paper out from under the silk screen. The word OPEN was printed on it. Mrs. S. said, "Why don't we try a blue one this time?"

Peggy walked to the chalk ledge and put her paper on it. She picked up chalk and wrote 'Peggy Jo.'

Peggy's story is called Working at School. Peggy drew a pictrue and labeled it 'HeIDI' (small e). The picture was a dog, her puppy.

Peggy walked to a table by the window. She wrote on a piece of paper 'POPCORN BALL.'

Peggy had only one encounter with grammar recorded in the Anecdotal Record. Since the observing teachers were not present for the whole session each day, it is not known if other experiences were had. The experience in grammar centered around the message of the day, which was searched for mistakes. Peggy was not actively engaged.

> Message of the day was read. Children looked for mistakes in the message. Billy, Jimmy, and Barbie did the correcting. They capitalized days of the week and the first words of sentences.

The children who volunteered during this correcting were those who were the oldest members of the group. Each had been in first grade and several had been in second grade during the past winter.

I found it extremely difficult to separate spelling and writing. Each seemed to overlap the other. The words Peggy wrote were: OPEN, Peggy Jo, HeIDI (small e), POPCORN BALL, and the number 56 (her house number). The above words belong in both areas. In writing them, she utilized both spelling and writing.

In the room where Peggy worked, creative writing played an important part. Nearly every day, if the child chose to do so, the child could dictate a story to Mrs. S., while she typed it on the primary typewriter. Before the end of the Institute, these stories were typed on a ditto and run off. The copies were put into a book and sold in the classroom store. Peggy wrote four stories with illustrations. All of her stories were put into the classroom book. The topics they chose were entirely their independent choices; however, most of the stories were developed from activities taking place in the room. All of Peggy's stories are being included because they are particularly important to this abstract, as examples of her verbal expression.

MY PUPPIES

I have four puppies. I play with them. I hold them. I love to play with them on the floor, but my mother doesn't let me because my brothers may step on them. I am going to build a house for my little puppy. My puppy is black. Her name is Heidi.

MY LIGHT

I made a light go on. I made the electricity. I used one battery and attached the wires on. I attached the light on. I scotch taped the wire to the table. I made a long wire.

MY PUPPY'S FENCE

I hammered my fence on to my dog house but my brothers tore it apart. My father put it on and my brothers did not like it on. My fence was coming loose so I had to hammer it. I painted it greyish blue.

WORKING AT SCHOOL

My puppy keeps on climbing out of the box I made. I made it out of wood. I hammered it. It took me four days to make it. When I took it home, I put my puppy Heidi in it. When I go home I am going to Evans School. I am going to play games there and I am going to fix my tiles.

Tomorrow I am going to be the cooker when we make popcorn. We are going to sell it for our store.

In summary, it is felt the area of languare arts was well correlated to the program. In the informal atmosphere which existed, the children responded enthusiastically to oral reading of daily messages. Several children were quite unresponsive to reading and correcting during the early sessions, but soon they also were participating eagerly. Peggy was one such child. From the record it can be observed that she participated very little during the beginning weeks; however, by the last part of the Institute, she was eagerly responding.

Several children, Peggy included, had not been to first grade yet, but were picking out beginning sounds and whole words. One child going into second grade said, "Don't let Diane and Peggy do it. (Pick out a word from the message) They're getting good and they haven't

gone to first grade yet." This comment was made to one of the instructors during a morning when Peggy and Diane were actively participating in the reading of the message.

Many vocabulary words were learned, not by memorizing, but by daily contact with the tools and materials available. The children used these new words in their creative writing.

Peggy benefited greatly from the Institute. She had many new experiences which would never have been possible otherwise. Academically, she is ready for classroom instruction.

VOCABULARY BUILDING
Primary - Girl
Summer 1966

by

Mary Holzschuher

Joan was the youngest participant in this program. Never having had any previous school experience, she adjusted very well. She came willingly, entered into the activities, and even made some worth-while contributions.

Joan has not yet attained the age of five. For this important date she must wait until the 16th of September. She is an only daughter, the baby of the family, and the pride and joy of not only her parents but, also, of three brothers.

It is interesting to note that Joan was born in Philadelphia, Pa., September 16, 1961, her father in Kingston, Pa., and her mother in Brooklyn, N. Y. Both parents are high school graduates. Her father continued his education in a mechanical training program. The family moved into the township in 1957. Joan's brothers are all attending schools in the township. Her father is the head janitor of the township schools and her mother proudly lists her occupation as housewife.

Joan has normal vision and hearing; has had the required immunizations: vaccination, D. P. T., and Sabin poliomyelitis; and, to date, has had none of the childhood diseases. She stands 44 3/4" high and weighs 42 pounds. She has big, bright, dark brown eyes and medium brown hair worn in a short bob with a quaint little top-knot top and center of her head. She is very alert, quick of movement, and an incessant talker.

VOCABULARY BUILDING for the Kindergarten child is of necessity based on hearing words properly pronounced, carefully enunciated, and correctly used. Thus, if the words are introduced in meaningful context and adequately maintained by repeated usage they will gradually become the child's own. A sense of security results as a child develops a meaningful, precise, and adequate vocabulary.

For a child to feel at ease in a Technological Program the building of a vocabulary peculiar to this field is essential. Since vocabulary building is dependent on an abundant in-take of ideas, this program readily and amply supplies this demand.

It has been amazing to watch the expanding knowledge, increasing vocabularies and growing creative responses as the summer progressed. Reading, and reading, and re-reading Joan's anecdotal record has been a revelation. While she seemed to be ever flitting about on high heels or changing shoes, occupying the doll corner, or coloring, it is surprising to see how her vocabulary has expanded.

Here are some pertinent words that have been followed through to show how Joan has grown:

Handles - Joan's idea was about handles on pots and pans. Here she made handles for a jumping rope, learned where and how it is best to hold the handle or a hammer and a saw, the use of a vise handle, the different shape handles on other tools, and the long straight handle of a broom.

Saw - Joan's father being a carpenter and janitor, she no doubt knew a saw before, but here she learned about other types of saws: hack saw for cutting metal, jig saw for cutting different shapes on wood, and the sabre saw; more important, she used these saws.

Circle - Joan's concept of a circle was broadened. She knew that an orange and a ball were circles, here she learned to arrange chairs in a circle, that electricity travels in a circle (unbroken line), she traced around a spool and drew a circle, she cut out a circle using a jig saw.

Hammer and Nails - These, too, were familiar to her; but here she used them to create. When Miss S. or Mr. J. or a child needed a hammer or some nails Joan was able to help.

Pulley - This tool seemed to be new to her. At first Joan just looked at it and seemed content to know its name. Later she had the opportunity to see it work and then to actually use it herself. A concrete block that she could not lift with her hands she lifted easily by the pulley.

Electricity, Conductors, Batteries, Dry Cell - These seemed to be new words and new ideas to Joan. When they were introduced she seemingly showed little interest: Joan took off her shoes and felt inside. She put her shoe on the floor and wiggled her foot until the shoe was on. Apparently, however, she absorbed more than I realized, for the next time electricity was discussed Joan knew the terms and uses of them. She made a light bulb work.

Sawdust - Joan did not seem to get the name for the dust made from sawing: Once she brushed some into a neat little pile and said, "Don't step on that stuff." Another time she referred to it as snow coming down, saying as she sawed, "There's snow coming down."

Joan needs to be helped to speak more carefully: She used 'bout for because, and she consistently dropped the final "g" on many words: makin', paintin', workin', helpin', etc.

The observations lead to the feeling that a Technological Program provides a wide variety of experiences at every level to stimulate free, imaginative, and emotional responses from the children. Such a program, well organized and sequentially developed, would add to each child's growing aesthetic maturity and sensitivity. Providing experiences, such as this program can, would help greatly toward developing healthy personalities, because it can be carried over into all areas of learning. Discussing and planning these activities with the children increase use of and a constant growth of vocabulary.

NEW WORDS USED

measured
favorite
lots
sticks
quit
aren't
sanding
dough
build
guinea pig cage
write
sanded
saw
friends
paintin'
wire
saw dust
stuff
makin'
cuttin'
shingles
asbestos
hammer
painting
cause
standin'

helpin'
drill
janitor
hop-scotch
sawing
stools
clamp
muscle
size
tired
split
wash machine
ring
sweeper
Mountain Dew
screw
middle
workin'
screw driver
slipping
plier
conductors
air conditioners
electricity
bulb
light bulb

astronaut

INDUSTRIAL ARTS AND SCIENCE
Primary - Boy
Summer 1966

by

Barbara Pawlowski

Dave, a dark-haired first grader, was born February 24, 1960, in Camden, N. J. He was one of six children--four girls and two boys. His father, a native of Philadelphia, is a salesman, and his mother, born in Oaklyn, N. J., is a housewife.

Other than the childhood diseases of chicken pox and German measles, Dave has a record of no physical defects.

In the November Parent-Teacher Conference report, the kindergarten teacher noted: "Dave is a conscientious student and trips on any new activity. His work habits are good. He trips until he masters a new idea. Dave is quiet in a group, but gets along well individually with other students."

The final kindergarten record reports Dave is "A moody child with occasional stubborn and belligerent days. He must constantly be reminded to pay attention. He does average work."

Dave displays an enrichment of scientific experiences, while encountering industrial arts activities.

The first project undertaken which pertained to science was a home for two guinea pigs. Miss S and Mr. J pursued the discussion: "Why do animals need homes?"

Dave retorted, "To protect them from hurricanes."

The problem then was encountered, "What kind of home would Noel, the pig, need?"

Rather than offer an answer to the group, Dave whispered to Richie. In turn, Richie called, "Put it in a cage."

Dave snapped, "Buy it!" when Miss S asked, "Where will we get a cage?"

Miss S inquired, "Could we make it?"

Not having any previous industrial arts experience, Dave responded with a shrug.

Dave did the work assigned to him, but he did not volunteer, and he did not appear to display interest in the cage. On July 7, the cage was almost completed. Rudy put Noel, the pig, into the cage for the first time. Dave only reacted with a glance over his shoulder at the cage. Then he continued to color a picture. Dave made no comment. His facial expression did not change.

As Dave's school record stated, Dave appeared to "trip" when encountering new experiences. The lack of interest displayed in this project might have been an example of Dave's timidity when encountering new experiences.

There is evidence of Dave expanding his knowledge of machines.

He displayed a developing mechanical vocabulary. He recognized machines. He appeared to know the purpose for machines, and how machines worked. Furthermore, Dave showed he realized the danger of saws.

Mr. J asked, "Can you get hurt with a saw?"

Dave responded, "Yes."

Dave learned the names of the carpenter's tools and used the words back saw, screw driver, clamp, and brace.

Dave recognized machines. Mr. J brought in a walking doll. When Mr. J questioned, "What makes it walk?" Dave whispered, "A machine." Even though the doll worked by batteries, Dave seemed to realize something helped it move.

Prior to the field trip where Dave saw a building torn down, Mr. J asked, "How would you tear down a building?...Burn it?"

Dave responded with a negative nod.

Mr. J continued, "What would you use to break up a sidewalk?"

Dave replied, "A shovel."

Following the field trip, Dave dictated two stories for Miss S to type. Dave expressed, "We rode the bus. We liked the big bridge that went over the river. We saw a bridge being built...We liked the bulldozer and ball and high crane that knocked down houses."

Then he commented to Miss S, "I know what I will draw...a big crane that we saw."

In Dave's second story, he dictated, "I saw a bulldozer digging dirt."

During group discussion after a trip to a housing development, Dave asked, "What was the machine with two shovels?"

Mr. J replied, "Back hoe."

Miss S asked, "How long is that?" (referring to the cage).

Dave replied, "Measure it."

Miss S returned, "What tool can we use to measure with?"

Dave got a yard stick. Richie and Dave measured with a steel tape measure also. They measured such objects as the cage, the tool cart, and ended by measuring each other's height.

Dave appeared to develop competency in use of tools. He supervised Carol when she was using the dremel jig saw. He clamped wood for the cage, while Richie sawed. He began sawing with two hands on the tool. By the end of the Institute, Dave was sawing with one hand on the tool.

Dave attempted to pick up a cinderblock by himself. The block only budged. Mr. J showed how a pulley helped to pick up things.

Dave was one of the first children to rush to the pulley. He smiled when it worked. However, when his turn was over, Dave did not watch the other children try to use the pulley. This sudden surge and decline in interest could have been because: (1) His curiosity was satisfied; (2) The novelty wore off; (3) His turn was over. Occasionally during the following weeks, Dave experimented with the pulley.

Dave had many encounters with machines, besides the instances he vocalized.

On the field trip he saw machines raise steel at an overpass bridge; he saw machines raise steel for high tension wires. He observed machines used in erecting prefabricated homes.

Dave watched wrecking machines destroy a building, and trucks cart the debris away. He saw a telephone man demonstrate how telephones are connected and work; he saw the tools a telephone man uses when he works on poles. Dave used printer's type, a printing box, wood blocks, and rolling pin to help "manufacture" a Memory Book for the children's stories. He used the mimeograph machine, and saw a typewriter used. In the play corner, Dave worked a hand mixer. Dave made a tray and commented that it was for "carrying dishes." He knew a clock told time. He played with a camera---clicked it, and looked through it. Dave made references to taking pictures.

Electricity and batteries seemed to capture Dave's interest. When Mr. J demonstrated to the group how batteries work, Dave got off his chair and stooped low to watch the experiment. (On previous occasions, Dave remained nonchalantly on his chair and glanced at the action.)

The children experimented with batteries to find conductors and non-conductors. Dave and Raymond worked together testing such objects

as pliers, paint brush and screwdriver. Previously, Dave tended to be a follower in any project. He let others take the initiative to think up solutions to problems. However, in the electrical project, Dave seemed to show initiative in finding objects to test as conductors. When he and Raymond tested a screwdriver, the light blinked. "Hey! It worked!" called Dave. This sign of enthusiasm was a rare occasion.

On July 21st, Miss S asked Dave what he decided to do during his free period. At first, Dave shrugged. Then he said, "Electricity."

On this occasion, Dave was the only one to work with electricity. He tried to make a little light go on. He could only make it blink. However, Dave did not give up, as he had done on previous occasions. He worked with the battery and light until the light shone. Dave showed creativity for the first time. He needed a conductor. Dave used a screwdriver as a conductor. This was not unique, but the way in which Dave made the screwdriver remain in place had not been done by any of the other ten children.

In group discussion, Mr. J questioned, "Where does electricity come from?"

Dave retorted, "From wires."

Mr. J: "Where does the wire get it?"

Dave: "From a plug."

Mr. J: "Where does the plug get it?"

Dave shrugged.

Mr. J: "We will find out. We shall take a walk."

The children visited the electrical poles in front of the school and followed the wires to the boiler room where the power box was located. Dave did not question during the walk.

After the field trip to the housing development, the children were discussing what they saw. Dave mentioned a machine on the back of a truck. Mr. J called it a "Generator." Mr. J explained a generator makes electricity. Then he asked, "Why is it needed?"

Dave replied, "They couldn't get a plug."

Miss S was discussing why her electricity went off during the electrical storm the previous evening. Miss S commented, "The electricity went off. The food started to melt and then it stopped melting. Why?"

Dave answered, "Electricity wont back on."

During the building of a play house, Mr. J asked, "What is one thing in a house that runs electricity?"

Dave shrugged and then whispered, "A plug?"

After the house was completed and wired for a light, Dave was playing with the other children. He went to Mr. J and said, "The light doesn't work."

Mr. J asked, "Is it plugged in?"

Dave investigated and discovered that it was not plugged in. He then asked permission to "plug in the light."

During the cage building project, children brought lettuce for Noel, the pig. Dave did not follow the other children's example. However, one day Dave arrived carrying a brown paper bag. When he came into the classroom, he showed Mr. J a switch and plug that were in the bag. Dave asked if it could be fixed. After a couple of days had elapsed, Dave asked, "Can we fix the plug?"

There are three areas in which Dave had contact with science, but there is no anecdote to verify the conscious or unconscious effect they had on him. Still, the contact was present. These areas include a sun dial, chemical change, and sound.

Dave's sister, who was in the grade 3-5 division, made a sun dial. When she was standing in the room with her dial, Dave commented to Mr. J, "I want to know what a sun dial is." No further reference was made to it.

On two different occasions, Dave had contact with chemical change. After the field trip to see steel raised, Mr. J asked, "What will rust?"

Dave responded, "Steel."

One of the children brought a piece of asbestos shingle from the housing development trip. Mr. J held a match to the shingle to show it would not burn. Dave made no comment.

Numerous sounds surrounded Dave during the Institute. Dave occasionally glanced at the clock in the classroom when it chimed. The hand and jig saws, hammers, and electric sabre saw made different sounds. One time Dave commented that the saw "sounds like a dog."

He heard a phone ring, and walked to the door, glanced in the direction of the ring, and then returned to his activity.

The entire primary group composed an experience chart of sounds that they heard on a field trip:

"Big banging noises
The bulldozer pushing
Hammering
Steel coming up
Bumping
A motor starting
Dirt being pushed
Cement and rocks falling
Banging of the crane."

In general, Dave was found to be a "Boy of few words" in a classroom situation. Occasionally, Dave would test and giggle, especially when sitting in a circle for discussion. In smaller groups of two or three, Dave would carry on a conversation. For the most part, however, Dave was passive in a group discussion.

The type of incidents that occurred frequently were:

(1) When Dave was asked a question, his first reaction was usually a shrug of the shoulders. On occasions, he also answered, "I don't know."

(2) If he made a mistake, Dave would look up at Mr. J or Miss S with a slight smile on his face (almost a sheepish look).

(3) When Dave was apparently working with great concentration, he would rub his lips with his tongue.

(4) In his conversations, Dave talked a lot about baseball.

In science, Dave developed his technological thinking. At the beginning of the five-week period, when Dave was asked how to make something, he would react with a shrug of the shoulders. Miss S asked, "How can we get a cage for the guinea pigs?"

Dave answered, "Buy it."

By July 21st, Dave's thinking had been channeled more toward industrial arts. Instead of buying a new plug, Dave asked, "When will we fix it?"

There was a development in Dave's scientific thinking. For the first time, Dave had been exposed to an atmosphere of discovering how and why things work.

LISTENING SKILLS AND MATHEMATICS
Intermediate - Girl
Summer 1967

by

Mary O'Malley

The observer spent the week previous to the first day of the Children's Institute in meetings with the staff of specialists in technology, elementary curriculum and child development, and in becoming acquainted with the other observing teachers from various school systems. Lab periods explored the various tools which the subject had used at the Institute last summer. Discussions of factors that influence development, learning and behavior set up standards for information to be included in the observer's anecdotal record.

Team #4 consisted of eight boys and six girls from grades 4, 5, and 6, who sat at three large tables. The tables were in a u-shaped formation, and were made by covering six desks with a section of phywood. A work bench, a saw horse, a desk, a cabinet, and a tool bench were also in the room. There was a sink in the corner of the room.

Jeri sat at a table with three other girls and a boy. She was dressed in pink shorts, with a white shirt, socks and sandals. Her dark hair was cut short. She wore a wrist watch, and had a pink purse on her desk. She seemed to be one of the smallest girls in the class. She talked easily to the others, and glanced quickly around whenever anyone moved, or talked near her. Her blue eyes sparkled. She had a sweet, pleasant expression.

The available information gave her birth date as September 22, 1958. She will enter fourth grade and be nine years old in September. She had a brother and a sister in other classes in the project. She was one of four fourth-graders in Team #4.

An Analysis of the Anecdotal Record in Terms of the Data

How does math evolve from classroom activities that involve design exploration, manipulation and utilization of tools and materials? The projects made by Jeri made math meaningful. The subject had learned how to use tools last summer. This summer she enriched her experiences by making and taking home projects she could use, reuse and explore, to extend her learning and reinforce it.

All of the projects involved planning ahead, and checking for accuracy and control. The parts of the camera had to be measured so they fit exactly, and kept out light. The notes of the xylophone had to be cut in graduated $\frac{1}{2}$" sizes to match the tones of the scale. The ruler illustrated measures to the sixteenth of an inch, for making parts of the camera and xylophone. The stop watch showed the minutes and seconds necessary for each step in developing pictures. Sanding the pieces let her feel the difference between the geometric shapes - round, flat, oblong, square, triangular and cone. The subject would appear to have a readiness to work with fractions and mixed numbers, as a result of finishing projects that involved them - the camera, xylophone and rocket.

How did listening evolve from the classroom activities this summer? The data seems to indicate that requests for help lessened each week. Forty-three requests were recorded: twelve the first week, eighteen the second week, seven the third week, and six, the last week. Fourteen of these were directed to a teacher and fourteen to a fifth-grade girl who sat next to the subject.

It appears that she learned to listen to directions when they were being given to the class more often in the last two weeks than in the first two weeks.

Data on Listening (57 Items)

I. Asked for help from a teacher

A. Miss R. - 14 times
B. Mr. W. - 4 times
C. Miss D. - 4 times
D. Observer - 3 times

II. Asked a pupil for help

A. Judy - 2 times
B. Pedro - 2 times
C. Susie - 14 times

III. Gave help to a pupil

A. Maria - 4 times
B. Barbie - 2 times
C. Susie - 8 times

IV. Followed directions and completed a project

A. Camera and picture developing
B. Xylophone
C. Rocket
D. Ceramic bowl
E. School map
F. Name tag

Data on Math (58 Items)

I. Measurement

A. Linear Measure

1. Inches

Memo holder-4"
Pinhole camera-
1/16", 4¼", 5 1/8", 5¼", 2½", 4 7/16", 5 5/16"
Xylophone-
4", 5½", 6", 7½", 23½", 27", 14", 13½", 12½", 11½", 11", 10½", 10"
Rocket
3/8", 3/16", 1½"
Name tag

2. Feet

Rocket launch-10' circle
Picture taking-6' from camera

B. Time Measure

1. Minutes

Picture developing-
2 min. 10 min. 20 min.
Ceramics-
5 min. or longer in molds

2. Seconds

Picture developing-10 sec.
Rocket launching-5 sec. countdown
Picture taking-2 sec. exposure

II. Geometric Shapes

A. Oblong
School map
Xylophone
Bricks

B. Square
Pinhole camera

C. Circle
Rocket launch
Round bowls
Electric circuit

D. Triangle
Shelf to hold bowl

E. Rounded flat piece
Rocket fins

F. Round cone and body tube
Rockets

III. Vocabulary

A. Too small-name tag rocket design and card

B. Too big-part of memo holder

C. Too short-camera piece

D. Halves-xylophone notes, clay ball

IV. Computation

A. Estimation and test of estimation

School mapping
Name tags
Column addition
Memo pad
Camera
Xylophone

B. Fractions

Camera
Xylophone

C. Mass Production Stations

Shelves

2

SCIENCE
Intermediate - Boy
Summer 1967

by

Carl J. Roache

While attending the 1967 Summer Institute of Technology for Children, Juan, a student in Mrs. J's and Mr. R's class, was observed. Juan, who will enter the fifth grade at a school in Camden, was born in Puerto Rico, apparently of mixed Negro-Puerto Rican parentage. He and his family moved from Puerto Rico to Camden approximately three years ago. His brother also attends the Institute in one of the primary groups.

Physically, Juan is of average height for boys of his grade, being neither tall nor short. However, he is rather thin and slight in build. He is generally well-dressed and neat in appearance. Juan frequently wears plaid shirts with dark wash and wear trousers. He has occasionally worn Bermuda shorts; however, they apparently are uncomfortable for him because he constantly pulls down on the short trouser leg.

Because of the heavy emphasis on science in Juan's class, I have decided to structure my abstract in terms of the scientific terms, principles, tools, experiences, etc., to which Juan was exposed during his attendance at the Institute. Most importantly, I want to relate how Juan reacted to and interacted with these experiences. In order to accomplish these purposes, I have chosen to structure my data in terms of the following areas:

I Vocabulary
II Scientific instruments (tools)
III Scientific principles
IV Math concepts (as an integral part of science)
V Scientific attitudes (how expressed)

Juan encountered many new vocabulary words during his Institute experience. That these words were often new to him is evidenced by his frequently halting attempts to pronounce and use a particular vocabulary word. A good example of this is seen when, in a discussion of rockets, Mrs. J asked for the name of the straw-like tube used in rocket launching. Juan called out, "A laun ... launching ... something ..." Then, literally grasping at the air, he came up with the correct term, "launching lug." This was by no means an infrequent occurrence.

Juan heard many new terms in the discussion of electricity. A partial listing includes each of the following: magnet, galvanometer, alligator clips, generator, battery, simple circuit, source, control, load, conductor and rectifier. He seemed to be quite interested in electricity and consequently used several of the above terms in discussion. He showed that he understood the concept of load when he replied, "A television" when asked to give an example of a load. A more humorous example is seen when Juan teased Dick, saying that the alligator clips were going to bite him. He showed here an understanding of why the alligator clip was so named.

The unit on rocketry also exposed Juan to new vocabulary such as the following: Nose cone, fins, launching lug, burnout, ejection charge, nozzle propellant, retainer cap, delay charge, propulsion, and nichrome wire. These words related to rocketry seemed to be difficult ones for Juan who participated only in a discussion of the first three.

The names of the tools as well as the tools themselves seemed new to Juan. He had difficulty at first with pronouncing the name "try square" and with being able to pick out the tool. When Mrs. J pointed out the Exacto-knife, Juan hesitantly pronounced the word.

As the Institute continued, Juan developed an increasing proficiency in the use of tools or scientific instruments, for after all, a hammer or awl is as valid a scientific instrument as is a test tube when used in pursuit of science. For example, Juan grasped the hammer near the head at first and soon discovered that his wrist tired quickly. He realized himself that his instructors were correct in telling him to grasp the hammer farther back on the handle for he soon consistently assumed this grip. Other tools he handled included: Back saw, combination saw, screwdriver, try square, countersink, wire cutters, hand drill, electric drill and the jigsaw.

Juan also saw and handled purely scientific instruments particularly in the unit on electricity. For example, Juan observed a galvanometer as it registered the electric current in a magnet. He "heard" the electricity in a dry cell by using a headset. He apparently delighted in the vibrating sensation received from the T.V. rectifier as he magnetized a screwdriver, for he laughed.

Juan also was exposed to a wide variety of scientific principles. That he didn't know the names of the principles is of little importance. What is more important is the fact that he saw these principles in action and in fact demonstrated these principles to himself. For example, he saw Newton's action-reaction in principle at work in an attempt to launch his rocket. Much to his consternation, the rocket followed an erratic course and didn't climb very high. (It is interesting to note that Juan predicted his failure on the previous day, for he said, "I can tell mine's going to go crooked." He diagnosed the cause of his failure immediately after the crash, saying, "I know it wouldn't work right! The fins was on all wrong.")

Miss L's lesson on the hurricane exposed Juan to a demonstration of Ferrel's Law, which states that moving objects are deflected to the right in the northern hemisphere and to the left in the southern hemisphere. He participated in the construction of a hurricane generator. His job, which involved wiring bulb sockets to the top of the generator, enabled him to use the principles of electricity that he had encountered in the discussion of a simple circuit.

Juan also saw a demonstration of Bernouilli's Principle which explains why a plane is able to fly. His interest in this principle of flight was demonstrated when he turned to a child next to him and asked, "What are the two little bubbles on the wing?" He was told that they were air molecules. He seemed satisfied and listened with rapt attention.

The visit to the clay pit provided Juan with an opportunity to see how man has utilized nature to better his condition. He followed the clay from pit to processing plant. His hands were loaded down with samples of brick as he boarded the bus home.

The NASA demonstration also provided Juan with important scientific information. For example, he saw gas in liquid form--liquid oxygen--vaporize before his eyes. The demonstration showing the effects of inhalation of helium on the human voice demonstrated that this gas had certain properties that created this effect. The film "Aluminum on the March" also introduced the concept of properties of matter for it demonstrated that aluminum was versatile because of properties such as being light in weight, durability and workability.

Juan also discovered that mathematics was an important concept in his work. During the Institute, he utilized a number of measuring devices. He seemed to particularly enjoy using the flexible-rigid

steel rule because he frequently snapped it back and forth while using it. Other measuring tools used included the ruler, steel square, try and combination squares. He was also introduced to the concept of squareness and its importance while using the try square.

Juan also saw the pitfalls involved in inaccurate measurement. For example, in making the wooden sides for his plaster mold, he saw that the pieces didn't fit properly because of his carelessness in measuring pieces. Also, as previously discussed, he realized that the failure of his rocket was due to imprecise measurement and alignment of the fins.

Juan was exposed to several mathematics concepts during his trip to the brick factory. He watched as a rectangular section of clay was cut precisely into bricks of a certain dimension. He watched as bricks not conforming to specifications were discarded. It was one of these discards, in fact, that he brought home as a sample.

At the brick factory, the group heard that because of mechanization, the plant was now producing several times as many bricks with fewer workers than it had produced ten years ago.

The concept of mass production was later reinforced in the last activity the class undertook. Juan saw that through mass production the class could produce a large quantity of note pads for distribution at the Institute luncheon. He was able to see his skill and speed as a worker increase as he worked at his specialized task of printing a title on the pad cover.

In summary, then, the Institute provided Juan with many rich scientific experiences. He was exposed to many new words and principles, many of which he grasped. He made many errors, and he seemed to profit

from his errors. He knew why his rocket failed. He understood why the sides of his wooden mold didn't fit. He began to pay more attention to fractional parts of an inch. He seemed proud when his measurement of a length of electric cord was more accurate than the measurement made by one of the biggest boys in the class.

Juan apparently enjoyed his Institute experience. His attitude toward the Institute was perhaps best expressed when in a children's evaluation group, he was asked if there was any activity he had done that he didn't like. He replied simply, "No. I liked everything."

MATHEMATICS
Intermediate - Girl
Summer 1966

by

Joan C. Errickson

Joyce was born in the Mid-west on June 6, 1955. She moved to the township in 1963. She is a tall, 60 inches, sixth grade student. At the present time she weighs 80 pounds. She has blond hair which she wears curled at the ends. Her eyes are blue.

Joyce has normal vision and hearing. Her T.B. test was positive, but the X-Ray was negative. She is asthmatic, allergic to weeds, animal hair, etc. and has chronic bronchitis most of the winter.

Joyce has one brother. Her mother and father both graduated from high school. Her father works as a printer and her mother stays home.

According to her school records, in third grade the results of the California Mental Maturity Test showed she had a verbal I.Q. of 142. Her non-verbal I.Q. was 133 giving a total of 138. In fifth grade the results were verbal I.Q. 129, non-verbal I.Q. 119, and the total was 126.

Her achievement test results were:

DATE	GRADE	TEST	G.P.	READING	LAN.	ARTS	ARITH.
1/64	3	S.R.A.	5.5	5.9	6.0	.	4.6
1/65	4	S.R.A.	6.9	6.8	7.7	.	6.2
2/66	5	Iowa	V. 7.1	R. 8.0	L. 8.5	W. 7.8	A. 7.6

Report Cards
Grade 3 1963-64

Language	A
Reading	A-
Spelling	A+
Writing	A-
Soc. Studies	A-
Arithemetic	A+
Health	S
P. E.	S
Fine Arts	S

Joyce is a good student. She is eager to learn and adjusted quickly to a new school and state. At times she wastes her time and has to be reminded to complete her work.

Report Cards con't

Grade 4 1964-65

Language	A	
Reading	A	
Spelling	A	
Writing	A	
Soc. Studies	A	Superior Student
Science	A	
Arithmetic	A	
Health	S	
P. E.	S	
Music	S	
Fine Arts	S	

Grade 5 1965-66

Language	A	Very good student. Tendency to waste
Reading	A	time talking. Nice child but a bit
Spelling	A+	headstrong.
Writing	B	
Soc. Studies	A	Very creative. Loves to write poetry.
Geography	A	Working on class paper.
Arithmetic	B+	
Health	S	
P. E.	S	

Evidence of Joyce's encounter with mathematics is supported by the observations in the anecdotal record.

The range of the encounter covered vocabulary building of mathematical terms, the introduction and use of measuring tools, the introduction of angles, their measurement with a protractor, their inter-relatedness with the earth as a circle being divided with a grid of imaginary lines, computation, the introduction of written lists containing costs and numbers of materials needed, estimating with linear measure and time, fractions and their manipulation, large numbers and their meaning, and problem solving.

The children's vocabulary of mathematical terms was enlarged by the use of dimensions in all of their work. Terms like circumference, angles, diagonal, bill of materials, tape, try-square, zig-zag rule, steel square, combination square, center-punch, T-bevel, and protractor

were introduced while the children were making a sun-dial. Hydraulic brake, and pressure were discussed as the children studied the automobile brake and saw a spectacular experiment on what liquid pressure can do. Cost reduction, mass production, consolidation and cost versus profit were used at the refrigerator plant visited during a field trip. The term extension cord for extending the electric power was used over and over during the course when it was needed for the electric drill and the sewing machine. The miter box and miter saw were used for cutting angles.

Measuring tools were introduced and used during the lesson on how to measure, when the children were given articles of different shape and size to measure the dimensions. They learned how to count the fractional parts of an inch on a ruler. They learned that the dimensions length and width mean with the grain and against the grain in wood. They learned how to use the measuring tape, the zig-zag rule, the steel, try-square, and combination squares when they measured to build their sun-dials, their prairie schooners, their radios, and their telegraphs.

The children learned about angles, their measurement and their application to the earth as a sphere when they made their sun-dials. They saw that forty degrees north latitutde was a forty degree angle on the earth and could be measured with a protractor and a T-bevel. They computed the fifteen degree angle between each hour by dividing three-hundred-sixty degrees by the twenty-four hours in a day.

They made a pattern of fifteen degree lines meeting at a point so they could transfer it to the sun-dial face. They started with fifteen degrees and continued to add fifteen degrees so they could use a protractor for measuring the angles. They transferred their numbers

around the circle to hours in the day so their "clock" could be easily read.

Before they started any project the children made out a bill of materials stating what and how many were needed for the project. They multiplied to find how much and how many were needed for the whole class.

The idea of estimating and design was introduced with the discussions about the prairie schooner. They discussed comparison of the length of the schooner with the height of the mast and the length of the boom. They estimated the area needed for the seat. Joyce refused to let them measure her to see how much room she would need. They discussed the comparative merits of a twin bed and a double bed size sheet for the sail.

They learned about using standard width materials wherever possible to save time and trouble.

They discussed the amount they should charge for a ride if they got to keep the schooner. Joyce estimated the distance of certain blocks for rides. She wondered about the "worth" of their time and labor in building the schooner.

Joyce got to solve the problem of how to take apart a tricycle. She thought about time passing when she realized she had gotten it for her second birthday. She tested various sizes of wrenches to remove a bolt. She organized the parts into "sets" when she put all of the tricycle parts into one pile and all of Mr. B's tools back into the tool box.

The children were introduced to the concept of perpendicular when they had to square-up the cross pieces and the foot rest on the schooner.

They cut the sail on an angle, and Joyce discovered the disadvantage

of being left-handed. They measured carefully for the mast pocket. They made a design for the sail. It turned out to be a repitition of angles for a surfer's cross. Joyce's suggestion that they name it "The Surfer" was accepted by the group.

The children were exposed to many mathematical ideas during their field trips. The idea of more accurate and standard measurements with factory made house sections was introduced at the housing development. They also heard about paying people on a contractual basis versus by the hour.

At a refrigerator factory Joyce was exposed to the large numbers that were prices of many of the machines. She heard about the rising costs of materials and the need of better mass production methods as well as material substitution if product cost is going to be kept down. The children came back to class and ran a mass production project doing all of the mathematics involved in figuring the cost of each item.

They heard about plant consolidation and the loss of profits due to the labor problems.

Joyce understood the idea that products made in the speciality shop by their very nature of being special, had to be much more expensive.

The idea of fractions was discussed with the use of the ruler, changing fourths to eights etc. and tearing paper into equal sections. Joyce learned how to use the desk as a straight edge when tearing sandpaper.

The recipe for making paper had to be tripled when larger paper was desired. The children had to decide how much water, how many tissues, and how much starch would be needed for the larger size. Joyce wasn't too pleased to find out she had to carry six gallons of water instead of two.

Division involving division of labor was used frequently as children were broken up into equal or unequal groups for various jobs.

Large numbers and relative speeds were introduced during a discussion about light, distance and sound when the crystal radio was planned. Joyce's remark, "Wow! I'd hate to be riding on that," showed she was personally involved in the discussion when she was told that light travels 186,000 miles per second.

Her concern that she would not have enough wire as she estimated the amount left on the roll with the amount needed to take eighty turns on her coil for her radio proved justified. There wasn't enough.

Joyce gained a great deal in concrete mathematical experience during the five weeks. She thought about new ideas, experimented with new measuring tools, failed and succeeded in direct proportion to her own accuracy and effort.

Most of these concepts are not now taught in as meaningful a way in the present elementary school due to a lack of opportunity for and the need for this type of measuring etc. in the present "average" curriculum.